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Proceedings from a conference on braille production and services are summarized. Only equipment which is ready for use is considered. Specific methods of producing braille discussed include the following: use of plates from a stereograph, computer line printer, braille embossers or braille writers, continuous strip embossed tape from a teletype machine, MIT high speed electric embosser, dot print-out on an electric typewriter connected to a computer, optical to magnetic conversion of print, and domestic and foreign combination print and braille writers. Problems of distribution treated are the size of the braille reading population; costs of braille reading material; methods of providing newspapers, periodicals, and reference material; and the lack of communication between inventors of braille equipment and the potential user. Listings of seven projects in planning or in process, conference participants, and two references are provided. Appendixes describe a new braille teleprinter system and discuss design analysis for a braille production system. (KH)

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Editor's Notes

The summary of these proceedings has been edited by the staff of the Sensory Aids Evaluation and Development Center of the Massachusetts Institute of Technology under contract SAV 1057-67 of the Rehabilitation Services Administration (formerly the Vocational Rehabilitation Administration) of the Department of Health, Education, and Welfare and with additional support from the Hartford Foundation.

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The editing staff is grateful for the constructive comments provided by Mr. Robert Bray, Mr. Robert Gildea, and Professor Robert Mann.

Forward

Dr. Edward Waterhouse welcomed the participants in his role as chairman. His opening remarks included the following points:

a. This particular meeting was organized as a result of a previous conference held at the Library of Congress in January of 1967.

b. Dr. Waterhouse asked participants to confine their comments as well as they could to that equipment which is ready for use.

c. The principle aim of the conference was to improve braille production and braille services.

d. The key questions are:
"What is it?"
"What will it do?"
"What will it cost?"
"When will it be available?"

e. In more than twenty years of attending braille conferences, Dr. Waterhouse stated that more than half the time is spent informing the participants about braille. He did not feel it necessary at the present time since all participants were familiar with braille.

Prior to the meeting, draft copies of the thesis by Mr. Lou Goldish of M. I. T. were mailed to those on the invitation list. The thesis is on the subject of braille production and its market. In response to a request by Dr. Waterhouse for comments and suggestions for the agenda, Mr. Robert Gildea of the MITRE Corporation drew up a set of objectives for a design study which is included as Appendix B.

Important Points

There are at least five major inputs which later result in embossed braille. They are the following:

a. a sighted transcriber knows Grade II braille and is operating a braille embosser, a stereograph machine, or some other form of input equipment. (In this case, the contribution of technology may be to enable the skilled transcriber to go faster and exert less physical effort.)

b. a blind transcriber who knows Grade II braille and is operating a stereograph machine or some other kind of embossing equipment.

c. the sighted person who does not know Grade II braille and is operating a keypunch or some other form of input to a computer which does the braille transcription or translation.

d. compositors tapes which are converted to a format acceptable to the 709 series braille translation programs.

e. print readers which convert print to magnetic tape which is then fed through a computerized braille translation system.

Outputs may consist of plates from a stereograph, the output from a computer line printer converted to embossed braille, braille from a Perkins or other type of embosser, continuous strip embossed tape from a teletype machine converted for embossing purposes, the M. I. T. high speed electric embosser, a dot print-out on an electric typewriter connected to a computer, etc.

Optical to magnetic conversion of print with high speed and high reliability is now possible with selected and specially prepared type fonts. In addition, there is increasing capability in the area of commercial print recognition equipment to handle more type fonts. Commercial equipment is now available which may be rented for very reasonable rates considering the amount of material converted in a given period of time. We can seriously consider the optical reader as an input which can later result in Grade II braille.

The conversion of at least one form of compositors tapes (teletypesetter) has been demonstrated on August 18 and November 18, 1966 at conferences sponsored by the Sensory Aids Evaluation and Development Center. The "DOTSYS" computer system will be used later for other forms of compositors tapes e.g., linofilm and monotype. There is a trend in the publishing industry

towards the use of computers for editing purposes. This results in "clean" tapes which are as error free as the final publication in print.

Teletypesetter and linofilm readers now exist commercially as standard inputs to computers. The monotype reader does not exist commercially. A monotype reader has been constructed and initially tested for reliability at M. I. T. In a project in the Mechanical Engineering Department at M. I. T., a monotype to incrementally recorded magnetic tape system is being developed. Monotype tapes can then be converted to magnetic tapes which will be acceptable by the 709 IBM computer series and its braille translation program.

With the data processing industry moving towards time-sharing computer systems and the telephone company rapidly making available remote data links, we can conceive of using a telephone to transmit braille data form remote locations to central computer processing facilities.

A recommendation was made by the participants that a survey be taken of the incidents of the occurrence of "clean" tapes. The best estimate given was that about 20% of compositors are or will be using in the near future computers for editing purposes.

A small braille producer might utilize the services of a service bureau for braille translation. It would not be necessary for the small braille producer to own or rent a computer. The service bureau would maintain on hand the braille translation program.

Is not braille dying out? The question was raised as to whether any additional effort is worth it for braille. The answer was given that the use of braille is gradually growing. Its educational function is undeniable. Although the braille reading population is growing more slowly than the sound reading population, there has been a definite increase in the last ten years in braille readers from 9,500 to 17,000.

A question was raised concerning the use of Grade I versus Grade II braille. The answer was given that Grade II braille is indispensable for educational purposes. Furthermore, the majority of blind readers prefer the efficiency in the use of Grade II braille and they have built up a strong habit pattern which they would not wish to change.

Data can be transmitted on an ordinary telephone line using a data set and a TWIX. One application for a data transmission system might be to let a blind person query a central library facility to obtain any library materials he chooses. In the fall there is a plan to set up a

data transmission system in conjunction with a central braille materials library in Illinois. This particular project will begin with a data phone link between the central materials library and a suburban school. Multiple copies of braille output can be thermoformed. In this there will be a tape brailler but it is hoped later that there will be a page brailler.

The point was made that economics is a strong factor in whether or not we use data transmissions systems. If we want something very fast, we should be prepared to pay additional price for it. There are, however, a great many instances in which it would be far cheaper and also otherwise desirable to mail braille material.

In a residential school, a great deal of the material is read to the children. For example, at Perkins, fifty to sixty volunteers read a great deal to high school students. Although there is much material in braille, there is certainly not everything that children want. The use of such volunteers has social as well as educational values. It also makes it possible for the children to discuss their assignments with these volunteers.

One participant pointed out that there may not be very much braille that people want to read in comparison to the information in braille that they have to read for educational or vocational purposes. Why can we not have more braille material just for pleasure?

There are significant differences between the situation in the residential schools and in the public school system for blind children. In the residential schools, the lessons can be planned around the majority of the children. In the public school system, the planning must be done for each blind child in the midst of the vast majority of sighted students. The timing is critical in the public school system. Also there tends to be a greater variety of materials which must be prepared on very short notice.

Approximately 100,000 newspapers are prepared from compositors tapes. Many of these are virtually error free, particularly the major newspapers which transmit data to remote locations for printing. This includes papers such as THE WALL STREET JOURNAL. We could take advantage of this vast warehouse of information in producing newspapers in local areas for blind persons, particularly for the deaf-blind. Since the tapes are machine readable, the braille translation program and the braille production equipment could be fed these tapes. The net result would be that the braille newspapers could come out as quickly as the print version, were a system established to accomplish this objective.

Time-shared computer systems for instructional purposes can be adapted and used by blind persons. There are already computer instructional systems in private demonstration projects in a number of areas in the United States. There is one in suburban Boston, for example. It is hoped that the M. I. T. embosser installed in consoles might be used during the next school year as an output from a remote time-sharing computer facility to generate instructional materials very rapidly.

The suggestion was made that a braille edition of the clear type version of THE NEW YORK TIMES be made available on a pilot demonstration basis for three to six months. THE WALL STREET JOURNAL was mentioned as an alternative. Although the natural emphasis would be on making this service available to the deaf-blind, there are a number of blind people who might be sufficiently interested. The greater metropolitan New York area was given as the best place to start such a program.

There are approximately 700 deaf-blind persons throughout the country who read braille.

According to the Library of Congress, there are 928 active braille readers in the New York area. When students are added to this group, the population does not exceed 1,500.

A market survey of braille readers would probably turn up about 17,000 who read books from the Library of Congress. But, when you add persons who read magazines and other material, there are probably 33,000 to 35,000 active braille readers in the United States.

In considering the deaf-blind newspaper, two points were stressed:

a. Going from regional to a nationwide group will make our sample larger and, therefore, the conclusions will be more valid.

b. As the population of readers goes up, the per unit cost for producing braille material goes down.

In partial contradiction to these points, the question was raised as to whether the larger samples would be produced because, although the per unit cost goes down, nonetheless, the total cost for the project definitely goes up. It might be wiser to keep the overall cost down rather than be preoccupied with the per unit cost.

In discussing the original project by Recordings for the Blind to issue the "News of the Week in Review" on sound recordings, it was pointed out that a great deal of effort should be exerted to inform the reader

that such a service exists. There is no doubt that some good projects fail because people just are not aware of their existence. In a continued discussion of THE NEW YORK TIMES "News of the Week in Review" on discs, perhaps one of the reasons why it failed was that all the news contained on the sound recordings was broadcast on radio. Another reason given was that the cost of the project was too high. That is, the majority of the costs had to be subsidized. With a number of readers, this was a sizable cost factor.

The Library of Congress plans to add two braille periodicals to their library program in 1968. The Library of Congress will include as one of its factors in selecting the periodical whether a given periodical is on compositors tapes which can be used to produce the final braille by way of data processing equipment including computer translation and the automated stereograph system.

The Library of Congress is also interested in expendable magazines. That is, those magazines which can be produced at sufficiently low costs so that the blind reader could keep or destroy copies just as a sighted person does. This would save tremendous amounts of space which are currently used for storage in regional libraries. The Library is also interested in the study of reference material used by blind students, particularly in residential schools. Examples are The World Almanac and statistical abstracts of the United States.

Thus far computerized braille is restricted to the easiest books to transcribe that is, literary materials. What is needed even more is math, science, reference works, and other important publications for educational and vocational purposes. There is already a math braille translation program underway at the American Printing House for the Blind. There are also plans to work on the music braille translation program at APH. The real challenge is in these more complicated materials and formats.

Tabular materials can be handled by computers. An example given is the stock market quotations. The stock market has a computer which prepares and corrects the material.

Once the math translation program has been worked out, the only requirement for an input will be a person who is a fairly bright student. She need not know the Nemeth code.

Digital magnetic tape for computers is an excellent medium for storing braille books very compactly. An economic proof for such compact storage was discovered in a study of the Boston Library system. The conclusion was reached that if a book could be printed out for five dollars every time a request were made, it would be cheaper than storing the book.

A system must be established for obtaining compositors tapes if it is going to be feasible to generate braille books from this medium.

A difficulty lies in the bulk of compositors tapes. If a sizable quantity of such paper tape or film is kept on hand to answer requests, it will be necessary to have a much more compact storage form than the original paper tapes or films. We cannot expect the publishers or compositors to retain such tapes since they are generally thrown away once the final galleys have been printed.

There is generally a considerable lead time from publishers regarding the issuance of new books which will be very useful in utilizing compositors tapes for braille production.

A significant factor in planning the utilization of technology for braille production lies in supplying the manufacturer with numbers, i.e., numbers of users or units which will be utilized. What is the real market for the given equipment or computer programming?

When only a total of two or three copies of a braille volume is required, the thermoform process still remains as the most practical and cheapest method. On the other hand, if a central facility which supplies a great many organizations and individuals is set up using a computer printer, the costs of the braille might begin to be competitive with the thermoform process.

Questions were raised in terms of reader acceptance concerning the plastic material which results from the thermoform process. The school children really don't have any other choice so we can't say that they accept or reject the process. They simply have to accept it. In one very hot tropical and humid area, the children were reading plastic material without any noticeable difficulty. Some blind readers, however, believe that this plastic material slows them down. After a short period of time, they find reading uncomfortable and cannot maintain as rapid a reading speed as they can with paper.

In discussing braille transcribers, we are really talking about two kinds of people. The first group operates Perkins or other braille

embossers. The second group are stereotypers. The amount of training time and experience is much greater for stereotypers than it is for those who operate other braille producing equipment. The training time of a stereotyper is as much as eighteen months. There is a strong psychological factor with a stereotyper who is producing a zinc plate: errors are relatively difficult and time consuming to correct. In the case of a piece of paper, one can just throw away the piece of paper.

IBM now has a kit to convert two of their line printers to emboss braille at speeds of ten thousand characters per minute or higher. Earlier Honeywell made such a conversion kit. This Honeywell printer is now at the University of Southern California. The dot height of the embossed material can be changed because there is an impression control on the computer line printer.

Unmodified computer printers can also be used as braille "picture" makers. The M. I. T. braille embosser is now used experimentally in the Research Laboratory of Electronics at M. I. T. for two-dimensional tactual presentation.

The best application of the computer line printer might be in metropolitan school systems where the kit can be used part of the time with a computer printer to generate all the braille material necessary for blind children in a given school system. Nearly all large metropolitan school systems have computers and line printers.

Any of the data processing development should be considered as a part of a systems approach. If there is a computer line printer converted to emboss braille and there is no braille translation program, there is very likely to be little use for the line printer. Any kind of equipment whether it be as an input, a processing medium, or an output should be converted to Grade II braille. Unless there is a systems approach carried to a successful completion, there will not be a market for any of the developments.

In the course of the initial Honeywell line printer project, there was successful interpointing of the braille. This is a tricky process and can be achieved successfully only by someone highly skilled in the use of the line printer and its conversion kit. The interpointing requires two passes through the high speed printer.

There were marginally successful attempts by Honeywell to produce

plates on the printer. These plates were later used in the standard press to emboss braille. The initial efforts involved embossing plastic and lead foil. These were later built up by electro-plating.

If the computer line printer were used to produce plates for generating braille, all the braille plates produced in the United States could be done in less than a week on the converted line printer. What could really be done, then, with this tremendous production capability?

The Clovernook high speed press can produce forty thousand braille pages an hour. Seven stereotypers feed this high speed production instrument.

The Braille Book Review ia about 150 braille pages and is produced every other month in a quantity of about ten thousand.

The break over point between making copies on a converted line printer and a stereograph plate making machine is estimated presently to be about 16 to 20 copies.

The difficulty always with single side braille is the additional bulk or volume and weight. Nonetheless, all educational materials or any other braille material in which there are only a few copies is single sided.

The Library of Congress is thinking seriously of one or two central braille library depositories for those old books for which there are occasional calls.

Of the 17,000 braille readers, about two thousand read THE NATIONAL GEOGRAPHIC MAGAZINE. This might someday be one of the expendable magazines.

There was conjecture that persons in regional libraries of the blind do not want to get into the business of actually making books. This is not a traditional library function and would probably be resisted.

Although there is a Honeywell line printer converted to produce braille, there is no program currently on the Honeywell series for Grade II braille translation. It would be very simple, however, to write a small program to interface the output of the 709 IBM translation program with the input to the small computer which drives the Honeywell line printer. There is also no braille translation program at the present time for the IBM 360 series. The writing of a 360 program would be very straightforward, however, in the light of the considerable experience

which has been acquired in the past with the original 709 program and its current up-dated version.

Optical readers may not be accurate enough for use by the blind. Ninety-five per cent is about the highest accuracy so far for ordinary type fonts. Errors in braille seem to be more significant than the same amount of errors in print. Ninety-five per cent accuracy is probably not good enough for braille readers. Optical readers which are much more accurate are so expensive that they can be afforded only by the Department of Defense. One possible exception to the ninety-five per cent error rate is the Philco reader which can read at 180 pages per minute. The cost of renting the Philco optical reader is about $250 per hour. A recent estimate is, however, that this rate has now been reduced to $100-125 an hour.

A typical typist makes about one error every fifteen to twenty-five words. The point was made that at the American Printing House for the Blind, the error rate for key punch operators is considerably better than the one in seven thousand mentioned for key punch operators on the west coast.

One participant indicated that Grade II braille rules affect the reader very little compared to the person who is generating the original braille material.

There are at least four braille keyboards in existence at the present time. The first was developed by Mr. John Wheeler, the second by Professor Woodcock, the third by Mr. Ray Morrison, and the fourth by IBM at Lexington. Although these keyboards have much in common and some were patterned after previous prototypes, there is at the present time no real standardization. An ad hoc committee out of the braille conference of November 18, 1966 has been established to try to arrive at one universally accepted standardized braille keyboard.

The Italian combination print and braille writer was discussed. Thus far anyone who has secured the Italian one has found it to be unreliable even for relatively short periods of time. The braille is just within acceptable thresholds.

The history of development instrumentation for braille production indicates that many of the people who came up with design features did not know the interests of blind readers or those who produced braille.

For the most part, there has been rather poor communication between the inventors and the potential market. The factors of cost, distribution, and evaluation are also often neglected by the original developers.

The Fugi Seiskusho braille writer produced marginal braille in terms of dot height. It was also Grade I braille with virtually no braille indicators.

A recommendation was made that an ad hoc committee be established out of this conference to provide some future liason and continuity in implementing research and development so that braille production services might be improved. Robert A. J. Gildea was chosen as chairman. He was then asked to pick his own committee.

There was a difference of opinion concerning desirability of contacting braille producers concerning market applications. Before the actual research begins, frequently there is just negative response. It was also pointed out that in many cases there is considerable experience concerning equipment which was developed and then appeared on the market. This is true of a great many things used by the sighted population in general.

When there was a criticism concerning the lack of communication between researchers and braille producers, a spokesman stated that there was a meeting in the early to middle 1950's in which every technologist who might contribute to the meeting was invited. These included persons from Europe. On the other hand, the consensus of the group was that there should be a regular systematic exploration of the potential applications of the devices. The time period between these meetings should not be greater than once a year. Possibly it might be as often as every six months.

There was general agreement among the participants that the next meeting of the braille implementation group be held in Louisville at the American Printing House for the Blind.

A prime consideration among manufacturers in marketing braille instrumentation is that the equipment must be a relatively simple adaptation of existing equipment. The market is not large enough to warrant the considerable effort to develop new equipment.

After considerable debate concerning the desirability of proof-reading the output of the high-speed computer line printer-embosser, the conclusion was reached that the accuracy was so high that proof-reading it was

unnecessary. After all, the line printer-embosser is only a converted line printer. An inaccuracy in the printing of material in the commercial area is so rare that it makes the front page of newspapers. In addition, the output of the printer is so fast that no human being would be able to keep up with it anyway. Random checks or samples of the material could be read but until such time as unreliability is demonstrated, it is a waste of time to do so. Until the computer line printer breaks down, and the breakdown is a major one, the system is infallible.

There was a heated discussion concerning the fact that blind people seem to be bothered more by errors in braille than sighted people are by errors in print. One point of view stoutly defended was that if blind people expect to be treated as equals of sighted people, they should tolerate the same error rate and not expect special privileged treatment. The other side contended just as strongly that the reason why errors were somewhat more significant in braille was the manner of sensing, i.e., using the tactile channel and the inability of the blind person to scan quickly as a sighted person can. The debate ended with neither side convincing the other.

A very interesting project might be the establishment of an automated library for the blind similar to those being designed now for sighted persons.

One of the best public relations situations occurs when the persons in the community are involved in projects for the blind. The extensive availability and use of volunteers creates a great deal of understanding by the sighted population of the problems of the blind.

The meeting adjourned with a number of short speeches which pointed out the worthwhile objectives which had been achieved during the meeting.

Projects

1. A complete book can be converted from compositors tapes to Grade II braille. The organizations involved will be the Library of Congress, Division for the Blind and Physically Handicapped, the Sensory Aids Evaluation and Development Center, M. I. T., the American Printing House for the Blind, and a cooperating publisher and compositor.
2. A magazine available on compositors tapes will be converted to Grade II braille. The organizations will be the same as in number 1.
3. A small booklet will be selected or specially prepared which will tell blind people what computers are like, what they can do, and how they are related to braille production. This booklet will be embossed in sufficient quantities and will be issued as expendable braille.
4. The booklet or some other short publication can be produced on the converted computer line printer. This can be either the IBM unit or the Honeywell line printer now installed at the University of Southern California.
5. The partially electrified Perkins brailler can be made more quiet. One unit has been forwarded from Howe Press to the Sensory Aids Evaluation and Development Center. Other units can be made available by Howe Press to interested researchers.
6. A cooperative project will be established between the mechanical engineering sensory aids group of M. I. T. and Clovernook to provide an ongoing technical consultant capability.
7. A newspaper for deaf-blind readers can be made available as a pilot program for six months.

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1. Braille Research and Development Proceedings, November 18, 1966. Sensory Aids Evaluation and Development Center, 292 Main Street, Cambridge, Massachusetts.

2. Xerox of a final draft research bulletin for a masters thesis by Lou Goldish entitled, "Braille in the United States."

APPENDIX A

A NEW BRAILLE TELEPRINTER SYSTEM

Ray E. Morrison

A six-unit braille language is in a form which can be adapted easily to a teleprinter coding with the new eight level equipment now available. Six levels can be used for intelligence and two for control purposes.

A study of the braille dot arrangement shows that dot 6 can be added to nineteen of the characters to produce a new character. Thus, the "lower case-upper case" shift feature of the standard typewriter can be used to reduce the number of key levers required. For example, in Figure 2 "A" is dot 1, "CH" is dot 1,6; "B" is dot 1,2 while "GH" is dot 1,2,6, etc. Note that "The" in Figure 3 is formed by adding dot 6 to the character for "S". This shift key for adding dot 6 is labeled "AUX". The associated "AUX" code bar is coded to prevent false addition of the dot 6 by key levers to which this feature does not apply.

Since in braille the numbers are represented by the first ten letters of the alphabet (preceded by the # sign), the top row of the typewriter keyboard is available for the special braille punctuation and composition signs. Key levers for dot 5-5,6(LTR) and dots 4,5-4,5,6 are added for the two cell combinations. Note the word sign for "time" in Figure 3.

Figure 4 shows a braille keyboard based on the standard typewriter layout and which includes all the 63 different braille characters. One of the new 4 row keyboards was modified with new key tops and with code bars coded for the corresponding braille characters.

Output from the keyboard signal generator is in the form of an eight level 11.Ø unit serial signal. This operates a monitor printer in a local circuit and, transmitted by wire line or radio to a distant point, will operate an embossing unit when fed into a receiving selector. For local embossing, a contact is added to each of the keyboard code bars to obtain an eight level multiple wire output signal for the embosser, or the serial signal from the keyboard signal generator can be fed to a receiving selector as above.

The local monitor printer is of interest. A standard eight level typing unit was used with the type box equipped with special braille type pallets. A sample of the monitor ink printing is shown in Figure 3.

An added feature of this equipment layout is that the standard seven key lever brailler can be used for transmitting by adding a contact to each of the key levers. The output is on a multiple wire basis and can be fed to a distributor to produce an eight level 11.Ø unit serial signal for use as above.

For recurrent braille embossing or transmission, a tape reperforator and a tape reader are added to the setup. Thus, once a book or article has been taped it can, at a later time, be reproduced or transmitted to a distant location for embossing as required.

The receiving embosser is under development and when ready will make this system very versatile. All in all, while somewhat involved equipment-wise, this system will increase the efficiency and ease of braille transcribing.

This braille keyboard and associated equipment was developed as a contribution of amateur RTTY to the blind. Correspondence is invited with anyone interested in further work with this method of braille embossing.

This article is based on a paper presented at the NInth Annual CHI-RTTY Meeting, October 27, 1963, in conjunction with the 1963 National Electronics Conference in Chicago, Illinois.

APPENDIX B

This excerpt and attachment is taken from a letter from Robert A.J. Gildea to Dr. Edward J. Waterhouse, April 25, 1967.

"I feel that the agenda reflects the parts of the braille production problem that are under investigation and that the whole problem needs attention. My view is that a braille press needs step-wise plans, schedules, and cost estimates that show the gradual phasing from today's processes to a fairly flexible future production system. The flexibility of such a system must be considered because we do not know enough today about our needs five to ten years in the future. To my knowledge, the required analysis is not being conducted today for either preliminary or detailed design specifications. It is necessary to go through such design activities in order to prepare reasonable cost estimates as well as alternative approaches. The May meeting would have been an excellent opportunity to discuss such a proposed design and its implications because the five areas will be represented: technology, education, government, agencies, and braille presses. Failing this, Friday afternoon may provide the opportunity for recommending such an analysis and initiating it with a set of objectives that reflect the requirements that may be elicited from the people attending the meeting. This analysis is a non-trivial task and will require

1. financial support (probably cost-sharing between the presses and the government),

2. a reasonably detailed system specification as a product,

3. thorough evaluation by an ad hoc committee, and

4. a presentation at another meeting such as the one being planned for this May.

The objectives that first occur to me for such a design task are given in the attachment and are not complete, but are offered as a starting list.

There should be some part of the two day meeting devoted to the other side of the coin, that is, having educators, representatives from government, agencies, and braille presses tell the technologists what their more severe problems are. Because I feel the meeting will be an important one, I hope that

arrangements can be made to produce and distribute written proceedings.

Attachment

Suggested Objectives for Design Analysis for a Braille Production System

1. Contact

   a. researchers;

   b. educators;

   c. government agencies, e.g., Library of Congress, Office of Education, VA, VRA, et al;

   d. private agencies concerned with work for the blind or brailling, e.g., AFB, NBA;

   e. individuals and federations of the blind;

   f. braille presses.

2. Obtain from each a list of features and capabilities that are given in order of highest priority first, for example, these features may delineate

   a. input media such as electric typewriters, various punched cards, magnetic tapes, telephone line communication data sets, teletype, another computer, and possible a special reader for automatically proof-reading master metal zinc plates from a stereotype.

   b. Grades and types of braille, such as standard English braille, the new Nemeth scientific code, music, and Grades I, I 1/2. and 3.

   c. Functions, such as direct entry of text, editing print proof copy, saving or re-loading uncontracted English form of full or partial books, special maintenance and testing of equipment, and electronic proof reading of electroplate output.

   d. Output media such as electric typewriters, display scopes for braille or print characters for proofing braille or print, modified line printer, brailler, or on-line stereotyper, magnetic tape, punched cards, punched paper tape, operator console, telephone data set, and teletype.

3. Produce three designs with specifications detailed enough for competitive bidding for

   a. total system responsibility,

b. those equipments of the system available and in production,

c. software,

d. special devices requiring development.

4. The three designs should be

a. a minimal cost, single purpose terminal unit. Terminal here means that this system need not be gracefully expandable to larger and larger capacity and more functions;

b. a minimal system, that is fully compatible with and expandable to a large system in graceful stages, such as with add-on hardware and software packages;

c. the large, fully extended system, that is, the mature form of b. above with its graceful expansion.

5. Operating system requirements and instrumentation.

6. Test plans and test procedures for acceptance.

7. Maintenance requirements for hardware and software for the terminal system, as well as for all stages of growth in the compatible system.

8. Guidelines and philosophy for sizes and scheduling of add-on features (hardware and software packages per add-on).

9. Prepare lists of required documents with descriptions of each."